



ASSEMBLY, INSTALLATION AND  
OPERATING INSTRUCTIONS

CARDINAL JUMBO RAM®  
for the COMMODORE AMIGA A1000® COMPUTER

REVISION 1.00

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The CARDINAL JUMBO RAM  
INSTRUCTION MANUAL

SECTION 1. General Information

1.1 Purpose.

The CARDINAL JUMBO RAM adds 512k or 1 megabyte of additional random access memory to the Amiga A1000 computer. It installs on the bus expansion connector on the right side and takes its power from the Amiga computer. The additional memory enhances individual programs, speeds compilations through use of the RAM disk and enables more programs to be in operation at the same time under the AmigaDOS multi-processing operating system. The purchaser is supplied with a printed circuit board, the random logic integrated circuits and installation software. The purchaser will need to supply the RAM integrated circuits separately or they can be obtained from CARDINAL at prevailing market prices.

1.2 Description.

The CARDINAL JUMBO RAM is a single printed circuit board 4" high and 8.5" deep. A single connector mates with the Amiga A1000 bus connector. It is provided as a semi-kit with all connectors, sockets and components soldered in place. The purchaser completes assembly by inserting

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the integrated circuits and testing and checking out the completed unit following the instructions provided in this manual.

Installation software is provided to add the memory space to the AmigaDOS operating system. The purchaser can either use the automatic installation feature of the software or can install it manually under the Command Line Interpreter (CLI) function of AmigaDOS.

Assembly is rather simple and straight forward, however, if you have no experience at all with putting something like this together, it is suggested that you discuss it with someone who has or that you read up on the subject to become familiar with the appearance of printed circuit boards, integrated circuits and the like. This will provide you with more self-confidence so that you can work with the JRAM assembly without feeling that you are running on the edge of some imagined disaster. By all means, don't feel that you have to be an electronics expert.

If you are the adventuring type, or have some experience with digital electronics... proceed!

## SECTION 2. Assembly

### 2.1 Preparation.

The integrated circuits used in the CARDINAL JUMBO RAM are sensitive to static electricity. To prevent damage, the anti-static sheet that the PC board is contained in should be used as an anti-static work surface. When working on the PC board, all integrated circuits and the PC board must be kept on the anti-static work surface. Keep a wrist or arm on the anti-static work surface before and while contacting the integrated circuits. This will avoid the build up of a static electricity charge between your body and the integrated circuit leads.

### 2.2 Random Logic Installation.

First, install the random logic integrated circuits according to the following instructions. These are the ones between the two long rows of chips along the top and bottom of the board. Check to see that you have the following integrated circuits:

- 74HCT00E 1 each
- 74HCT04E 1 each
- 74HCT32E 2 each
- 74HCT123E 1 each
- 74HCT138E 1 each
- 74HCT157E 2 each

It is critically important that the pin 1 ends of the integrated circuits all point towards the left side of the printed circuit board. If reversed, the integrated circuits will be damaged.

Install the integrated circuits using figure 1 for placement. Note the "UP" that is etched into the printed circuit board. This will help to orient you for the assembly work.

The individual pins on the integrated circuits normally bend slightly outwardly and will need to be pressed inward to mate with the sockets. They can be held against the table top (of course on the anti-static work surface) and gently bent in. Even better, use an integrated circuit insertion tool. These tools are available from Radio Shack and many other sources.

### 2.3 RAM Integrated Circuit Installation

Second, install the memory RAM integrated circuits. These are installed in the same manner as the previous integrated circuits except the pin 1 ends will point towards the top of the printed circuit board. These are installed in the two long rows of sockets on the top and bottom of the PC board. The 1 end of the integrated circuits are installed pointing to the top of the printed circuit board. If you are only installing 512K of RAM, install the RAM integrated circuits in the left 8 sockets on the top row and the left 8 sockets on the bottom row.

The RAM integrated circuits are standard 256K X 1, 150 nsec or better dynamic RAMS. Check the file "RamChips" on the software disk for the latest listing of the brands and model numbers of those integrated circuits we have experience with. While this list can't be guaranteed, it is a good starting point for use while shopping for these integrated circuits.

#### Good

Hitachi  
Fujitsu  
AT&T  
Texas Instruments

#### BAD

Micron Technology

### 2.4 Visual Inspection

Now, double check the assembly to make sure that there are no errors. Take a break, relax, get something to drink and read section 3.9 now to see what some of the possible errors are. Time spent on this now can avoid some real grief in a few minutes when you fire up the board for a test drive.

This completes assembly of the CARDINAL JUMBO RAM. Testing will be done after the installation of the software, so proceed to do that at this time.

## SECTION 3. Installation

### 3.1 General.

The software disk supplied with the CARDINAL JUMBO RAM provides for the automatic installation of the software necessary to make the AmigaDOS operating system aware of the presence of the additional memory. For those familiar with the inner workings of the AmigaDOS system, this installation does two things. First, it adds the AddMem program under the "C" directory and secondly, it adds the AddMem command to the Startup-Sequence while saving the old Startup-Sequence as Old-Startup-Sequence. If you are not familiar with this, don't worry, it is done automatically.

### 3.2 Use.

The CARDINAL JUMBO RAM software is only installed on the Workbench disks that are used to boot up the system. These are the disks that are inserted when the picture of the Workbench disk appears. Even when the memory is on the computer, some of your disks may not need the extra memory. This is typical for many of the games. It is not necessary to install the software on every disk, as the AmigaDOS operating system will just ignore the extra memory if it isn't told about it. In most cases, people only boot up a very few disks and then run most of the rest. In these cases, installation is only required on those few boot disks and should not take much effort to do.

### 3.3 Workbench Versions.

The CARDINAL JUMBO RAM software works with either Kickstart 1.1 or 1.2 and installs the JRAM software on Workbench 1.1 or 1.2 disks. It is important to not do an auto-installation twice on the same disk as the machine will lock up. In the event this happens, it can be corrected either by copying over a new copy of Workbench and then reinstalling or by editing the Startup-Sequence to remove the second AddMem command. This can be avoided by marking the label "JRAM" to indicate that the installation has been made. Any copies made of the disk after installation should also be marked.

### 3.4 Initial Testing.

For initial testing of the CARDINAL JUMBO RAM, make a copy of Workbench. Then install the JRAM software and run a few programs to insure correct operation. When initial testing is completed, go back and install the JRAM software on the rest of the boot disks as desired. It is suggested that the original Workbench disks that were delivered with your com-

puter be left unmodified and installation only attempted on copies of the originals.

### 3.5 Running Auto-Installation

To begin the auto-installation, bring the Amiga computer up with kickstart. When the picture appears instructing you to insert Workbench, insert the JRAM Auto-Installation disk. The auto-installation program will display instructions and will eventually ask to insert the disk for installation. The disks should be working copies of the boot disks and when installation is complete, the label should be marked "JRAM" to indicate the installation and to avoid reinstallation.

### 3.6 Manual Installation.

Purchasers familiar with the CLI interface may prefer to install the software manually. To do this do two things:

1. Copy the file AddMem contained in the C directory of the JRAM software disk to the C directory of the target disk.
2. Edit the Startup-Sequence file contained in the S directory of the target disk to add the line:  
AddMem 200000 2FFFFFF for 1 meg of RAM or  
AddMem 200000 27FFFF for .5 meg of RAM.

### 3.7 JRAM PC Board Installation.

Turn off the Amiga power. Remove the cover plate that covers the expansion bus on the right hand side of the main computer unit. This cover plate should remove with a little gentle prying with a small screwdriver or finger nail. It should not require much force and you should avoid scratching the case. Look to see how the connector on the rear of the JRAM board mates with the printed circuit board edge protruding in the expansion hole.

Look at the JRAM board and find the "UP" that is etched into it with an arrow pointing up. Turn the JRAM board with this arrow pointing up and slide the JRAM board connector onto the expansion bus of the Amiga. The JRAM case can now be gently slid down over the board.

### 3.8 JRAM Test Drive.

Turn on the Amiga and load the Kickstart. Then, use the Workbench disk that has the JRAM software installed to boot up. The Workbench should come up with the memory available showing on the order of 1400000 for a 1 meg load of RAM and the 256K add-on memory that plugs into the front of the machine. With 512K in the JRAM board and the 256K add-on the available RAM should be around 800000 or 900000. A good first trial is to start several clocks and observe everything running properly.

With the installation of the JRAM, all the programs will be assigned to the JRAM (this is called fast memory) and the internal Amiga memory will be reserved for video memory (this is called chip memory). Thus you are running in the new memory and have passed the main test.

Having done this successfully, try some memory hungry programs and observe that they also run properly. Having completed the tests successfully, go back and install the JRAM software on the rest of your Workbench boot disks.

### 3.9 JRAM Troubleshooting.

If the JRAM doesn't work on the test, the most likely problem is that one or more of the integrated circuits are inserted backwards. Carefully recheck the board to see that the 1 ends are pointing in the correct direction. If the random logic integrated circuits were installed backwards, the chances are very high that they got very hot, hot enough to smell funny, will be bad and must be replaced. Replacement integrated circuits are available from CARDINAL at a nominal cost. It is also possible that if one of these is reversed, it can cause a failure in one of the properly installed integrated circuits.

If the memory integrated circuits are inserted backwards, they just might still be good. (This is not for sure, but we have seen some survive the ordeal without smelling funny!). In this case, turn them around and try again. Of course, carefully note which were turned around so you can know the most likely ones to replace in the event they are bad. Don't trust it to memory, write it down.

The next most likely problem is that the wrong integrated circuit is installed in a socket. Double check against the layout figure to see if this is the case. Next, it is also possible that one of the integrated circuit leads has been bent under the chip rather than going down into the socket. Careful examination under a strong light will normally reveal this problem. If in doubt, slightly lift the integrated circuit from the socket to make it more visible.

Also, if the computer locks up during boot up right after the message about adding memory, it is possible that the disk got the AutoInstall run on it more than once. Check the S/Startup-Sequence file to verify that the AddMem statement only occurs once. The command to view this is:

```
type df0:s/startup-sequence
```